

## **SECTION 18360**

### **SIGNAL SYSTEMS MISCELLANEOUS PRODUCTS**

#### **PART 1 - GENERAL**

##### **1.01 DESCRIPTION**

- A. Section includes requirements for miscellaneous components and products for signal systems.

##### **1.02 REFERENCE STANDARDS**

- A. American National Standards Institute (ANSI)
  - 1. C80.1 Electrical Rigid Steel Conduit
- B. American Railway Engineering and Maintenance of Way Association (AREMA):
  - 1. Communications and Signals Manual of Recommended Practices (C&S Manual). When following the recommendations of the AREMA C&S Manual substitute the word "shall" for the word "should" in the applicable Manual Part.

##### **1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's catalog cuts, material descriptions, specifications, and other data pertinent to the miscellaneous products required.
- B. Submit samples of solderless crimp-on type terminals.

##### **1.04 EXTRA MATERIALS**

- A. Furnish two gallons or equivalent volume of corrosion preventive compound. Compound shall be the same product as approved for use in the Work.

#### **PART 2 - PRODUCTS**

##### **2.01 GENERAL**

- A. All electrical components shall be rated to operate at power, voltage, current, and temperature levels exceeding by 20 percent those which the components will be subject to in service, unless otherwise specified herein.
- B. Miscellaneous components and products shall be clearly and permanently labeled with value or type identification.

##### **2.02 CIRCUIT BREAKERS AND FUSES**

- A. Circuit breakers and fuses shall be of suitable capacity to protect the various pieces of signal apparatus from the effects of short circuits or overloads. All circuit breakers

and fuses required for the equipment and systems shall be in accordance with these Specifications.

- B. Circuit fuses shall be non-renewable, and shall be of the fiber-case, time lag, fusion type.
- C. The circuit breakers and fuses shall be the correct size and rating for circuit current interruption and shall protect the electrical equipment and circuits from short-term and long-term overloads.
- D. All circuit breakers and fuses shall be centrally located on the power distribution panel and power racks.
- E. Fuse clips shall be constructed so that they shall retain their resilience under all installation and service conditions, to ensure a positive contact between the clips and the fuse.

### **2.03 DIODES**

- A. Diodes to be furnished under this Contract shall carry a JEDEC number or shall be available from more than one manufacturer, and shall be used within the published specifications for such number. All diodes shall be silicon type, unless otherwise accepted by the Engineer.

### **2.04 RESISTORS**

- A. Resistors, other than those required for electronic circuits, shall be in accordance with AREMA C&S Manual Part 14.2.15.

### **2.05 REACTORS**

- A. Reactors, other than those required for electronic circuits, shall be in accordance with AREMA C&S Manual Part 14.2.20.

### **2.06 SIGNAL TERMINAL BLOCKS**

- A. Signal system terminal blocks shall be in accordance with the applicable recommendations of AREMA C&S Manual Part 14.1.5.

### **2.07 TERMINAL BINDING POSTS**

- A. Signal system terminal binding posts shall be in accordance with the applicable recommendations of AREMA C&S Manual Part 14.1.10.
- B. Terminal binding posts for interface with plug-coupled wires to rack mounted electronic equipment shall be in accordance with the recommendations of AREMA C&S Manual, Part 14.1.2.

**2.08 TERMINAL POST INSULATORS**

- A. All terminal posts, located on terminal boards in the wayside cases, signal instrument shelters used to terminate 50V, or greater, ac or dc circuits shall be provided with a protective insulator.
- B. The type of insulator shall be individual for each terminal post and shall be fire-resistant.

**2.09 INSULATED TEST LINK**

- A. Type 024620-1X as manufactured by Invensys Rail, or Engineer approved equal.

**2.10 LIGHTNING ARRESTERS AND EQUALIZERS**

- A. Invensys Rail Clearview No. 022485-28X, Equalizer No. 022700-1X, or engineer approved equal. Lightning arresters and equalizers shall be mounted on accepted type base and shall be in accordance with the recommendations of AREMA C&S Manual Part 11.3.1.

**2.11 SURGE PROTECTORS**

- A. Invensys Rail SP-17, SP-18, SP-19, SP-20, or equal. Surge Protectors shall be in accordance with the recommendations of AREMA C&S Manual Part 11.3.3.

**2.12 TERMINALS FOR WIRES AND CABLES**

- A. Solderless terminals shall be in accordance with the recommendations of AREMA C&S Manual, Part 14.1.1, unless otherwise specified herein.
- B. Terminals shall be of the solderless crimp-on type. Samples of all solderless terminals shall be submitted for approval.
- C. Stranded copper wire shall be fitted with an approved type of terminal at all points where the wires are to be terminated on terminal binding posts.
- D. The terminating means shall be of four types:
  - 1. A lug for terminating heavy wires or signal power wires.
  - 2. A solderless type of terminal as manufactured by TE Connectivity, Inc., under the trade name of "Pre-Insulated Flags" with translucent insulation similar to Catalog No. 322313, or equal, for terminating No. 16 and No. 14, American Wire Gauge (AWG) stranded wires.
  - 3. An AMP Solistrand "Ring Tongue-Flat" terminal, similar to that shown on the AMP Drawing P64044, together with slip-on nylon post insulator, similar to that shown on AMP Drawing P64-0264, or equal, for terminating wires larger than No. 14 AWG to a maximum diameter over the insulation of 0.40 inch.
  - 4. An AMP preinsulated; diamond grip ring nylon insulated wire terminal shall be used for terminating other stranded wires, No. 20 and No. 18 AWG,

having maximum diameter of 0.125 inch. AMP Catalog No. 320554, or equal, shall be furnished for No. 8 studs and AMP Catalog No. 320571, or equal, shall be furnished for 1/4-inch studs.

- E. Terminals shall be for attaching to the ends of the conductor in such a manner that the flexibility of the conductor will not be destroyed and the possibility of breakage at the terminal will be reduced to a minimum.
- F. Terminals shall be for attaching to the wire with a tool made by the manufacturer of the terminal and recommended by the manufacturer for the terminals being furnished.
- G. The tool shall be equipped with a ratchet device to ensure proper indentation of the terminal, which will not release until proper indentation is complete.

### **2.13 TAGGING FOR CABLES, WIRES AND EQUIPMENT**

- A. Except as otherwise specified in this Section, permanently identify with a tag both ends of each cable, each cable wire, and all single wires that terminate in the junction boxes, switch mechanisms, signal instrument shelters, on equipment racks, relay bases, shelter and any equipment of the signal system outside of such locations. Install tags so that they may be read with a minimum of disturbance of the tags. Each conductor of the cable shall be rung out and identified before applying the tag. Tagging shall follow the three-line convention with the termination in the first line, nomenclature in the second line, and termination of the other end of the wire in the third line. (From - To)
- B. Tags for wire and cable identification and for identification of transformers, resistors, reactors and other components shall meet the following requirements and shall be subject to Engineer's acceptance:
  - 1. Sleeve Type Tags:
    - a. Tags for identifying individual cable conductors and field-installed wires within the signal instrument shelters, wayside cases, switch mechanisms, switch layout junction boxes, base of signal junction boxes, and similar applications, shall be the sleeve type as manufactured by Raychem Corporation, Thermofit Marker System (TMS), or equal. The application of the conductor nomenclature shall be in accordance with the manufacturer's instructions and shall result in a permanently bonded and legible identification.
  - 2. Flat Plastic Tags:
    - a. Tags for identification of vital relay plug boards, individual transformers, resistors, reactors, terminals, and other miscellaneous components within the signal instrument shelters, wayside cases, and outside terminal cases, shall be the flat plastic laminated type.
    - b. These tags shall be 1-1/2 inches long by 1/2-inch-wide. The untreated tag shall be milk white "vinylite", or Engineer approved equal.

- c. The identifying nomenclature space shall allow for two rows of lettering, and the tag material shall be capable of receiving typed-on characters by conventional means. The height of the lettering shall not be less than 1/8 inch.
- d. After lettering, both the face and backside of the tag shall be covered with a clear plastic coating, "vinylite", or Engineer approved equal.

## 2.14 HARDWARE

- A. Mounting hardware exposed to the elements and used for signal equipment, cases, conduit, hangers, brackets, clamps, and the like, shall be hot-dip galvanized in accordance with AREMA C&S Manual Part 15.3.1, except as otherwise accepted by the Engineer.
- B. Galvanizing:
  - 1. The hot-dip process of galvanizing shall be used. All parts shall be picked so that all scale and adhering impurities are removed. The zinc coating shall be of commercially pure zinc, and shall be continuous and thorough. It shall not scale, blister, or be removable by any of the processes of handling or installation. The finished surface shall be free from fine line cracks, holes, or other indications of faulty galvanizing. It shall be smooth and free from adhering flux and other impurities. The edges and ends of parts shall be free from lumps and globules. Parts shall be coated with at least two ounces of zinc per square foot of galvanized surface, after all bending, cutting, drilling, and final fabrication.
- C. Cadmium Plating:
  - 1. Nuts, bolts, and washers shall be cadmium plated or stainless.
  - 2. Cadmium plating shall be an impervious, dense, hard, fine grained, continuous, closely adhering coating of commercially pure cadmium, free from capillaries and shall completely cover the surface of the part in a smooth, bright layer. Plating on raised or prominent portions shall show no evidence of blackness or loose crystalline structure. It shall have a minimum thickness of six ten thousandths of an inch and shall withstand the salt spray test for at least 1,000 hours or an equivalent test accepted by the Engineer.

## 2.15 CONDUIT

- A. Rigid conduit:
  - 1. Steel Conduit: Steel conduit shall conform to ANSI C80.1 and shall be installed as shown on the Contract Drawings. Where elbows are used, they shall be long radius type. Steel conduits shall be protected in shipping and handling by approved thread protectors.

2. Polyvinyl Chloride (PVC) Conduit: Thick wall polyvinyl chloride conduit, high impact schedule 80, herein referred to as PVC conduit, shall be installed as shown in the Contract Drawings. Where elbows are used, they shall be the long radius type.
- B. Flexible Conduit
1. Conduit for track circuit leads, switch-and-lock movements, and electric lock layouts shall be Liquid-Tite flexible conduit or equal. The conduit shall be clamped at both ends with stainless steel clamps. Clamps are not required for track wire risers.
  2. Metallic Flexible Conduit: Where acceptable to the Engineer, metallic flexible conduit, Type UA, or engineer approved equal may be used.
- C. Fittings
1. Approved fittings for flexible conduit shall be used.
  2. Approved fittings for PVC conduit shall be used.
  3. Fittings for rigid steel conduit shall be of cast malleable iron and shall be protected by hot-dip galvanizing.

## **2.16 PADLOCKS**

- A. Switch padlocks will be Owner-furnished.
- B. Signal padlocks will be Owner-furnished. The Contractor shall provide temporary padlocks until such time the equipment is placed in-service.

## **2.17 SEALING COMPOUND**

- A. Sealing compound for use in sealing cable entrances shall be in accordance with AREMA C&S Manual Part 15.2.15.

## **2.18 CABLE ENTRANCE PIPES**

- A. Cable entrance pipes for wayside signal shelters shall be 4-inch PVC, Schedule 80, and 3 feet 6 inches long and extend 18 inches below the final grade.
- B. Cable entrance for wayside signals shall be 4 inch Liquid-Tite flexible conduit or equal. Entrance pipe shall extend 18 inches below finished grade around signal.
- C. Cable entrance pipes are not required where a cable chute directly enters a pullbox.

## **2.19 JUNCTION BOXES**

- A. All junction boxes shall be provided with gaskets to prevent the entrance of moisture and dust, in accordance with AREMA C&S Manual Part 15.2.10.

- B. Junction boxes shall be provided to terminate underground cables at all switch and lock movements and all switch circuit controllers.
- C. Junction boxes shall be provided with means for applying padlock.

**2.20 LUBRICATION**

- A. Lubrication for switch tie plates for all switch and lock movement layouts installed by the Contractor shall be an accepted graphite lubricant, similar to Dixon's Graphite "Railroad 60".

**2.21 ENVIRONMENTAL PROTECTION (CORROSION PREVENTIVE COMPOUND)**

- A. Protection, as hereinafter specified for machine-finished surfaces, threaded rods, nuts, and other parts that are susceptible to rusting or corroding, shall be a corroding preventive compound, NO-OX-IDE No. 90918, or equal. The product shall have sufficient body to resist weather and rusting for at least 6 months.

**2.22 DC TRACK CIRCUITS**

- A. Transmitters shall be a 1TC, 2TC, or 3TC manufactured by GETS Global Signaling or Engineer approved equal.

**2.23 STYLE C TRACK CIRCUITS**

- A. Transmitter shall be a TD-1A driven by an ACG-2T or TD-4 manufactured by GETS Global Signaling or Engineer approved equal.

**2.24 AUDIO FREQUENCY ISLAND TRACK CIRCUITS**

- A. Audio frequency island track circuits shall be AFTAC-II manufactured by GETS Global Signaling, PSO manufactured by Invensys Rail, or Engineer approved equal.

**2.25 AC TRACK CIRCUITS**

- A. AC Track Circuits shall be steady energy such as the SE-3 manufactured by Invensys Rail or Engineer approved equal. Vane Relays shall not be used.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Material and apparatus specified herein shall be installed in accordance with the details of respective Sections of these Specifications, manufacturer's recommendations, and in accordance with the Contractor's accepted installation drawings approved by the engineer.

**END OF SECTION**